theory must correspond qualitatively and quantitatively to the phenomena of Nature. The analytical difficulties may be too great to deduce all the phenomena, but if any be contrary to experience, the theory, at least in its exact form, must go. It is only by inventing, discussing, comparing and remodelling as many theories as possible that we can hope to arrive at any knowledge of the constitution of matter or of the æther. This new and very original attempt is therefore to be welcomed. As a rule, authors of such theories are satisfied to show how many facts their theory explains, and how probable, therefore, it is that their theory corresponds to reality. Not so, however, Prof. Osborne Reynolds. He claims to have shown that "the research has revealed the prime cause of the physical properties of matter," and that

> "there is one, and only one, conceivable purely mechanical system capable of accounting for the physical evidence as we know it in the universe."

That a theory coming from Prof. Reynolds will fulfil the first of our conditions goes without saying. But that it should be possible to give a proof that it *is* the representation of the actual structure of æther and matter is too astonishing to be received without scepticism. We await the publication of the full research.

It is not possible to criticise a complete theory on a short statement of its results—a statement which by its very nature must leave much vague and much unsaid. Sufficient idea, however, is given to cause us to look forward to the complete work, which is, we understand, to be published by the Pitt Press shortly. In brief, the æther is composed of equal rigid spherical grains (diam. $= 1{\cdot}7 \times 10^{-12}$ times the wave-length of violet light) arranged in regular and closest order, and under great pressure. When strained, such a medium must expand—or show "dilatancy." The actions of the medium depend on this dilatancy. Matter is a defect of matter—a small deficiency of grains or a "negative inequality," causing, so to say, a certain looseness in the gearing of the grains where the deficiency exists and a consequent stress in the medium outside. These inequalities are permanent, and are propagated through the medium without a transference of the grains themselves. Matter is, in fact, a strain which is propagated through the medium—an idea which has occurred to others, notably Dr. Larmor in his electron theory, and to the late Mr. C. V. Burton, at the Ipswich meeting of the British Association in 1895. These strains attract one another according to the Newtonian law, may cohere but not coalesce. "Positive inequalities" (due to excess of grains), on the contrary, repel one another and so are dispersed. Electricity apparently consists of double inequalities, excess in one place and defect in another. The statement here appears rather vague, and it is difficult to understand the difference between electricity and two inequalities, one positive and one negative. The attraction is, however, enormously greater than that of gravitation. Apparently the theory gives no explanation of the fact that electricity never shows itself apart from matter, nor is any explanation offered of the electrodynamic action of one current on a conductor bearing another. A true theory must do this, and it is the crux of every theory yet produced.

In this granular medium, transverse and longitudinal waves are propagated. It would take 56 million years to reduce the energy of the transverse to one-eighth, while it would take only four one-millionths of a second to reduce that of the normal by the same amount, thus, the author says, "accounting for the absence of normal waves." This, however, is only a proof that such waves do not last. It is necessary to show that on reflection of light they are not formed, otherwise they will diminish the intensity of the reflected ray.

Many difficulties and objections suggest themselves during perusal which will doubtless be answered in the full paper. If Prof. Reynolds does in this what he promises in the *résumé*, he will go down to posterity with a greater fame than Newton. If, however, he does not succeed in convincing us that he has solved the problem of the mechanism of the physical universe, he may yet be congratulated on giving us what is evidently a beautiful, illuminative and extremely suggestive theory. He has opened to us, in any case, a new field of knowledge as well as helped to stimulate that scientific imagination which we are told it is our bounden duty to cultivate.

W. M. H.

OUR BOOK SHELF.

Report of the Yellow Fever Expedition to Parà of the Liverpool School of Tropical Medicine. By H. E. Durham. Pp. 79. (London: Published for the University Press of Liverpool by Longmans, Green and Co., 1902.) Price 7*s*. 6*d*.

THIS is the seventh memoir published by the Liverpool School of Tropical Medicine, and it is printed and got up in the same excellent style as its predecessors. It embodies the results of the Parà expedition of Messrs. Durham and Myers, and is written by the former, Dr. Myers having, as is well known, fallen a victim to the disease he was investigating, a circumstance which lends a melancholy interest to the report. When the expedition left this country, the remarkable and conclusive work of the United States Army Commission in Cuba under Major Reed in proving the conveyance of yellow fever by gnats was not known, but this problem, with many others awaiting solution as regards the disease, was present in the minds of the observers, as is seen in the preliminary report, which is here reprinted from the *British Medical Journal*. In the course of their work, they became acquainted with the results of the Americans, and a number of observations are chronicled in the report with regard to the gnat (*Stegomyia fasciata*) incriminated in Cuba. It was bred in captivity and studied in its native haunts, and much useful information gathered as to its habits—the most striking being its essentially urban habitat, and its custom of biting by day and not at night.

With regard to the actual microbe which is the cause of yellow fever, no sufficient proof is as yet forthcoming, but the observations of the expedition agree with those of Agramonte and others in absolving Sanarelli's *Bacillus icteroides* from any share in its ætiology. Attention is, however, already called in the interim report, an abstract of which is here reprinted, to a small, fine bacillus which the English observers found with considerable constancy in the intestines and in the viscera generally in fatal cases, and to which they were inclined, with due reserve, to ascribe a causal significance. It had previously been observed by Sternberg and others, but not with the constancy here recorded. A valuable series of observations on the condition of the lymphatic glands in yellow

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fever and another series on the occurrence of peculiar proteid substances in the urine must also be noted.

Together with these positive results, there is necessarily included a mass of detail concerning results which proved negative. The writer has, further, added to his account of the experimental work performed a quantity of somewhat miscellaneous facts gathered in Para and elsewhere on the subject of yellow fever and malaria, with a general account of the sanitary condition of the town. But when it is remembered that the work of the expedition was in great part crippled by the illness of both and the death of one of its members, we can but congratulate the survivor on the work which was accomplished, regretting that opportunities were not forthcoming for carrying it to a further stage of completeness. Yellow fever is a disease which has long been a puzzle to sanitary science, but appears at the present day to be on the verge of explanation. An immense step in advance has been made by the discovery of its transference by the gnat; the complete solution of the problem must be attained by further investigations on the lines of those embodied in this report, and carried out by skilled and unbiased investigators such as those sent out by the Liverpool School of Tropical Medicine.

Eyes Within. By Walter Earle, M.A. Pp. 155. (London: George Allen, 1902.) Price 5*s.*

THIS little volume of poems contains some good references to Nature and her handiwork. We are led to realise the ever-changing condition of the earth's surface, and phenomena of many kinds are dealt with. Thus:—

> "See where upon a world-old mountain face
> Some mighty glacier has left its trace,
> A few faint scratches, all that marks to-day
> Time's agonies along his primal way."

Allusions are also made to the great variety of changes always going on around us, and to the disturbing elements raging ceaselessly in the interior of the earth:—

> "Shrill crash of breaker plunging in the cave,
> The soughing wind, waves grinding on the shore,
> Weird wail and scream of bird, set evermore
> In fuller diapason stern and grave."
>
> "Crack, rent and crush of overwhelming rock,
> Steam bursting into flood of liquid blaze,
> A world vibrating with each thunder-shock,
> Suns setting in a pall of wreckage-haze.

All through the book we are struck with the delicate and subtle way with which common and every-day occurrences are referred to. Birds, flowers, insects, all have their due.

The author shows the true poetical spirit in many of his descriptions, and reveals to us the joy of possessing an eye which goes beyond the *outside* of the objects around it.

Handbook of Instructions for Collectors. Pp. v + 137; illustrated. (London: Printed for the Trustees of the British Museum, 1902.)

WITH the view of obtaining the aid of naval and military officers, explorers, missionaries and others whose duty or inclination takes them to foreign lands in adding to the collections of the Natural History Branch of the British Museum, the Trustees have issued this excellent little handbook. It consists of a series of pamphlets describing the methods of collecting and preserving the various groups of animals, as well as plants, fossils and minerals. The different sections into which the book is divided have been written by members of the staff of the Museum, each of whom is a specialist in his own particular branch, and although the manner of treatment varies somewhat, each section is admirably adapted to its special subject, illustrations being introduced when necessary. The section on mammal collecting is divided into two parts, one dealing with the larger and the other with the smaller forms, a feature of the former being the inclusion of a list of species specially wanted by the Museum. Birds and the lower vertebrates follow next, after which come the various invertebrate groups, the work closing with chapters on plant and mineral collecting. The book is of a size convenient to be carried in the pocket, and has the corners rounded off the better to withstand constant use. R. L.

The First Principles of Ratio and Proportion and their Application to Geometry. By H. W. Croome Smith, B.A. Pp. iv + 32. (London: Macmillan and Co., Ltd.) Price 1*s.*

THE strict theory of geometrical proportion is difficult, and, with few exceptions, elementary students are quite unable to understand it. Opinions differ as to the compromise that is best suited for school teaching, and suggestions on this topic deserve careful consideration. Mr. Smith bases his method on the variation of two geometrical quantities; it is supposed that they vanish together and that any given increment of the one is associated with a fixed increment in the other; or, as he puts it, "when two variables change in such a way that equal changes in the one are accompanied *always* by equal changes in the other." A theory of proportion which starts from this idea is necessarily imperfect, and ignores the most troublesome part of the subject; but it will probably serve very well as a provisional compromise. At any rate, Mr. Smith's book deserves a trial.

Year-book of the Scientific and Learned Societies of Great Britain and Ireland. Pp. viii + 295. (London: Charles Griffin and Co., Ltd., 1902.) Price 7*s.* 6*d.*

THE nineteenth annual issue of this handy book of reference does not deal with a single calendar year, but with an actual working year of the great majority of the learned societies. Consequently, there are here brought together the papers read before the chief scientific societies throughout the United Kingdom from October, 1901, to June, 1902. The list of societies included in the new volume seems fairly complete, but we notice that the Geographical Association is not mentioned.

Papers on Etherification and on the Constitution of Salts. By Alexander W. Williamson, LL.D., F.R.S. (1850–1856.) Alembic Club Reprints, No. 16. Pp. 62. (Edinburgh: Published by the Alembic Club. Edinburgh agent, William F. Clay. London agents, Simpkin, Marshall, Hamilton, Kent and Co., Ltd., 1902.) Price 1*s.* 6*d.* net.

THE Alembic Club is doing valuable work by reprinting the accounts of classical researches in science in the words of the experimenters themselves. We are glad to know these reprints are increasing in popularity among teachers of science in schools where the "research" method of obtaining knowledge is encouraged. It is a matter for gratification, too, that this collection of papers, which have appeared in the publications of various scientific societies, has been printed during the author's lifetime.

Dove Dale Revisited: with Other Holiday Sketches. By the Amateur Angler. Pp. xiv + 130. (London: Sampson Low, Marston and Co., Ltd., 1902.) Price 2*s.* 6*d.* net.

THE amateur angler writes pleasantly of a beautiful country for which he has great affection. The volume is the seventh and concluding one of a series, and will encourage its readers to take an intelligent interest in animate and inanimate nature. The illustrations are numerous and exceptionally good.

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